ATACHMENT J-31
PHASE I SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

1.0 SCOPE.

1.1 Background. As the Coast Guard heads into the 21st century, all of the surface and air assets which perform missions in the Deepwater environment are approaching the end of their respective service lives. Deepwater missions are those missions which generally occur beyond 50 nautical miles (NM) from U.S. shores. These missions typically require either extended on scene presence, long transit distance to reach the operating area, forward deployment of forces, or a combination of these factors. In addition, the Coast Guard is faced with a constrained budget. The Coast Guard must therefore concentrate its scarce resources on an integrated system of surface, air, command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and logistics assets to maximize operational effectiveness while minimizing life-cycle costs. To accomplish this, the Coast Guard is seeking solutions from industry in a two phase acquisition program.

1.2 Phase I. Based upon the Coast Guard's statutorily mandated missions and current and planned asset capabilities, the Contractor shall develop an Integrated Deepwater System (IDS) concept of surface, air, C4ISR, and logistics assets. The Contractor shall consider the options associated with either acquiring new assets and/or retaining, retiring or upgrading current assets while maximizing operational effectiveness and minimizing life-cycle costs. The Phase I Contractors shall: develop an IDS concept, provide specific asset performance and cost information, prepare a phased plan for the acquisition and deployment of the proposed IDS concepts and have the capability to construct individual assets in its proposed IDS concept.

1.2.1 Functional Design. The Contractor shall further develop their IDS concept and associated assets, architectures, and plans to provide an engineering description of the IDS to the point where all system level requirements have been allocated to specific assets and other definable components, and the IDS assets and their major components and performance are not expected to significantly change as a basis for evaluation and possible award of the subsequent procurement contract. The required level of design for individual assets varies in the range of conceptual to detailed, depending upon each asset's proposed time period for implementation and design maturity (i.e., new designs, modifications to legacy assets, or CANDI). These levels are stipulated by the specific tasks identified in SOW Section 3.19 and SOW Attachments 1 – 4. The Contractor shall characterize their IDS, its assets and other components accordingly and conduct the corresponding tasks as described in this section and the attachments.

1.3 Phase II. The Coast Guard will select Phase I contractors to participate in Phase II where they will submit proposals with refined designs and costs to provide the system. The Coast Guard will evaluate these Phase II proposals and intends to award a contract to one of the contractors to build and provide the IDS. The actual Phase II statement of work will be issued with the Phase II solicitation.

2.0 FRAMEWORK.

2.1 Applicable Documents. The following are listed in their order of precedence to this statement of work.

2.1.1 This Statement of Work

2.1.2 Deepwater System Performance Specification (SPS) - PRF-ADW-001 (Attachment 0001)

2.1.3 Integrated Deepwater System Modeling and Simulation Master Plan (MSMP) - (to be incorporated into the contract at time of award as Attachment 0007)

2.1.4 Coast Guard Deepwater Acquisition Mission Performance Standards - To be provided at contract award in the Modeling and Simulation Master Plan.

2.1.5 USCG/Naval Operational Capabilities for the Future U.S. Coast Guard Cutter - 1 October 1997 - (available at **http://comms2.rdc.uscg.mil/deepwater**)

2.1.6 USCG Command, Control, Communications, Computers, and Intelligence (C4I) Objective Architecture and Transition Plan (OATP) - To be provided at contract award.

2.1.7 Joint Technical Architecture (JTA) Version 1.0 - (available at **http://www.itsi.disa.mil/**)

2.1.8 Defense Information Infrastructure (DII) Common Operating Environment (COE) - (available at **http://www.itsi.disa.mil/**)

2.1.9 MIL-STD 961D - Department of Defense Standard Practice Defense Specifications - (available at **http://www.acq.osd.mil/es/std/library.html**)

2.1.10 C4ISR Architecture Working Group (AWG) C4ISR Architecture Framework Version 2.0 - 18 December 1997 - (available at http://www.cisa.osd.mil)

2.1.11 Core Architecture Data Model (CADM) V2.0 – 1 December 1998

2.1.12 Level of Information Systems Interoperability (LISI) – 30 March 1998

2.1.13 Defense Data Dictionary System – 8 October 1998, Version 4.0 with Patch release 4.0.2.2 (available at http://www-datadmn.itsi.disa.mil/ddds/dds40.html)

2.1.14 Coast Guard Data Dictionary – August 1999

2.1.15 Joint Information Exchange Requirement Analysis Database (JIERAD) – 1 December 1998, Version 2.0

2.1.16 Hierarchical Data Dictionary (HDD) – August 1999, Version 3.0

2.1.17 Cutter Certification Plan (draft matrix topics provided under USCG letter dated 23 September 1999)

2.2 Considerations.

2.2.1 In developing their IDS concepts, Contractors should propose systems which maximize operational effectiveness while minimizing life cycle costs.

2.2.2 Contractors should propose systems which include, to the maximum extent possible, Commercial and Non-Developmental Item (CANDI) at the time of asset delivery.

2.2.3 Contractors should propose systems based on an open systems approach.

2.2.4 Contractors should consider the services provided by the use of U.S. Coast Guard overhaul, training, and support facilities.

2.2.5 Concurrent with this effort, a Presidential Roles and Missions study will be conducted on current and future Coast Guard missions. Any results from this study may require adjustments to the System Performance Specification (SPS) and the Modeling and Simulation Master Plan (MSMP).

2.2.6 The Coast Guard envisions that the JTA, the DII COE, and the National Information Infrastructure, in conjunction with the emerging Coast Guard Common Operating Environment (CG COE), will support Coast Guard information systems including supply, maintenance, training, administration, transportation, and medical functions as well as operational command and control.

2.2.7 The initial procurement of assets will be a result of the Phase II award and is anticipated to begin with initial Government contract award in FY 2002.

2.2.8 The Coast Guard may experience additional and/or changing missions in the course of the life of the IDS. Therefore, the Contractor should consider the advantages of proposing a system which is flexible and adaptable to multi-mission, multi-regional employment. Contractors should consider the degree of robustness of operational assets with respect to relocating assets or their capabilities to new operating environments, and adapting new capabilities to operational assets. These relocations and adaptations may occur on short notice with changing Coast Guard missions.

2.3 Definitions.

2.3.1 Asset. A set or arrangement of components which operate together to function in a desired manner satisfying one or more of the requirements of the System Performance Specification. Examples of present Deepwater assets are listed in Section 3.9 of the System Performance Specification, Attachment 0001.

2.3.2 Asset Concept Design. Translates asset performance requirements into engineering characteristics. It embodies technical feasibility studies to determine fundamental characteristics of the system. It validates alternatives analyses results, provides a firm baseline for functional design and supports preparation of a budgetary quality cost estimate. In the case of a surface asset, for example, this would equate to a Class F cost estimate as defined by NAVSEA.

2.3.3 Component. A separable portion of an asset or subsystem for which configuration beyond this level is not expected (e.g., a whip antenna would be considered a component if there is no intent to procure items which make up the antenna, such as the brackets, whip, or cable).

2.3.4 C4ISR Architecture. The design, structure, and arrangement of personnel, equipment, communication facilities and procedures employed to facilitate the command and control process; the "disciplined definition" of the information-related infrastructure employed to support the command and control process.

2.3.5 C4ISR Data Architecture. The description of common terms of reference, standardized definitions, and the establishment of logical relationships among information elements.

2.3.6 C4ISR Operational Architecture. An architecture category dealing with command and control organization, functions and information exchange. A description (often graphical) of the operational elements, assigned tasks and information flows required to support the mission requirements. It defines the type of information, the frequency of exchange, and what tasks are supported by these information exchanges.

2.3.7 C4ISR Systems Architecture. An architecture category addressing the overarching components of the C4ISR infrastructure. A description, including graphics, of the system and interconnections providing for or supporting a mission requirement. The system architecture defines the physical connection, location and identification of nodes, circuits, networks, assets, etc. associated with information exchange and specifies system performance parameters. The systems architecture is constructed to satisfy the operational architecture requirements per the standards identified in the technical architecture.

2.3.8 C4ISR Technical Architecture. An architecture category describing the logical and physical design of the C4ISR infrastructure components. A minimum set of rules governing the arrangement, interaction and interdependence of the parts or elements whose purpose is to ensure that a conformant system satisfies a specific set of requirements. The C4ISR technical architecture identifies system services, interfaces and standards, and their relationship, and provides the framework upon which engineering specifications can be derived, guiding the implementation of systems.

2.3.9 IDS Concept Design. A concept design which identifies the IDS concept of operations to provide the functional capabilities to meet the Coast Guard's statutory mandates. It defines the proposed mixture of a) surface, b) air, c) command, control, communication, computer, intelligence, surveillance, and reconnaissance (C4ISR) and d) logistics assets that meet the requirements of the SPS and the Modeling and Simulation Master Plan (MSMP). The purpose of IDS concept design is to explore system concepts, identify major risks and significant improvements, define the system for developing the life cycle cost estimate, and to establish a basis for further development of the system. The IDS concept design is the basis for the IDS performance specification.

2.3.10 Integrated Deepwater System (IDS). The organization of hardware, software, material, facilities, personnel, data, services and logistics, etc. needed to meet the SPS.

2.3.11 Integrated Product Data Environment (IPDE). The information system capability which implements, through phases, the integration of a central product model database, associated data products such as drawings, technical manuals, GFI, training materials, and program execution information such as plans, schedules, and procedures in order to satisfy the information requirements for both the Government and Contractor. The IPDE features the capability to concurrently develop, capture, update, and re-use data in electronic form.

2.3.12 Life Cycle Cost (LCC). The total cost to the government of acquisition and ownership of that system over its planned life. It includes the cost of development, acquisition, operations, maintenance and support (to include manpower), and where applicable, disposal.

2.3.13 Open Systems Approach. An open systems approach affects all portions of the IDS - mechanical, electrical, software, etc. This approach is a business and engineering strategy to choose specifications and standards adopted by industry standards bodies or de facto standards (set by the marketplace) for selected system interfaces (functional and physical), products, practices and tools. Selected specifications shall be based on performance, cost, industry acceptance, long-term availability and support, and upgrade potential. Open systems are those that enable properly engineered applications to be ported across many systems, to be able to interoperate with other applications on local and remote systems, and to interact with users in a style that facilitates user portability.

2.3.14 Performance Specification. A specification that states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. A performance specification defines the functional requirements for the asset and/or component, the environment in which it must operate, and the interface and interchangeability characteristics. Performance specifications shall not describe how a requirement is achieved, require the use of specific materials, or parts or give detailed design or construction requirements beyond those needed to ensure interchangeability or interoperability with existing or proposed items. The performance specification establishes performance and acceptance criteria for the assets as complete entities.

2.3.15 Technical Assessment Team (TAT) Objectives. To facilitate the best possible contractor performance during the functional design period, the Deepwater Project Office devised a teaming strategy that will encourage the most effective IDS for the Coast Guard from each Deepwater Phase I Contractor. To support this teaming strategy, TATs were formed to provide full time dedicated personnel from various Coast Guard offices, supplemented with contracted technical experts, to support the Deepwater Assistant Project Managers for Air, Surface, C4ISR, Logistics, and Modeling & Simulation (M&S). The overarching objective of the TATs is to build a partnership with each Contractor that provides a continuing two-way dialog. Specific responsibilities of the TATs include providing non-directive, uniform and timely feedback to the Contractor on Coast Guard technical, operational and support issues, and providing an in-depth understanding of Contractor methods, progress, and deliverables to the Deepwater Project Office and Coast Guard Headquarters Matrix Product Team members. Information provided by the TATs is not contractually binding unless it is also provided in the contract or formally relayed by the Coast Guard Contracting Officer.

2.3.16 System Integration Team (SIT) Objectives. The objectives of the Coast Guard SIT are to ensure integrating issues are addressed by internal Coast Guard functional areas of Air, Surface, C4ISR, Logistics, and M&S, and to gain insight to IDS Contractor integration efforts during the functional design period. The SIT consists of the Deepwater Deputy for Systems Integration and the Assistant Project Managers for Air, Surface, C4ISR, Logistics, and Resources and is supplemented with integration support staff. Information provided by the SIT is not contractually binding unless it is also provided in the contract or formally relayed by the Coast Guard Contracting Officer.

2.3.17 Total Ownership Cost (TOC). Total Ownership Cost is comprised of costs to research, develop, acquire, own, operate, maintain, and dispose of any and all assets comprising the IDS; other equipment and real property supporting the IDS infrastructure; the cost to recruit, train, retain, separate and otherwise support military and civilian personnel; and all other costs of business operations for the Deepwater missions. Some of these costs will be inextricably linked with the non-Deepwater Coast Guard and must be partially allocated or assigned to Deepwater TOC.

2.3.18 IDS Concept Baseline. The IDS Concept Baseline represents the Contractor's IDS as characterized in their Concept Design Final Study Presentation described in SOW Section 3.16.

2.4 Relationship of System Performance Specification (SPS) and Modeling and Simulation Master Plan (MSMP).

2.4.1 SPS. The SPS describes the capabilities needed to perform the Coast Guard's statutory mandates in the Deepwater environment.

2.4.2 MSMP. The MSMP establishes the operational profile for the capabilities listed in the SPS. The MSMP provides various operational profiles, which drive the IDS configuration. The operational profiles are regionalized to reflect the variability and range of Coast Guard missions. The regions include the Northeast, Southeast, West Coast and Hawaii, Alaska and International Operations. Additionally the operational profiles are multi-level to support evaluation of proposed systems over a spectrum of performance requirements. The multiple levels of operational profiles include a range from an "average" year up to and including temporary surges in operations such as mass migrations in the Caribbean basin, major pollution incidents and/or extended operations with the U.S. Navy.

2.4.3 Relationship. The SPS lists the "what" and the MSMP describes the "where", "how often" and "how much". As such, the two documents are interrelated when defining the IDS. There is a distinct difference, however, in the approach of the two documents. The capabilities listed in the SPS constitute the minimum requirements of the IDS, regardless of operational profiles.

3.0 REQUIREMENTS. The Contractor shall ensure that all the requirements listed below provide for a system that is compliant with the System Performance Specification, Attachment 0001.

3.1 Integrated Master Plan (IMP). Based on the input provided at the post award conference, the Contractor shall submit a revised IMP, which, upon Government approval, will replace Attachment 0006. (CDRL A001)

3.2 Integrated Master Schedule (IMS). Based on the input provided at the post award conference, the Contractor shall submit a revised IMS. (CDRL A002)

3.3 Alternatives Report. The Contractor shall provide a report describing the alternatives being considered in the Analysis of Alternatives as well as the rationale for selecting these alternatives. (CDRL A003)

3.4 Analysis of Alternatives. The Contractor shall provide an analysis of the alternatives which supports the selection of their proposed IDS and each asset which comprises it. The analysis shall include rationale for alternatives considered, operational benefits and relative costs, with all underlying assumptions clearly stated. For the C4ISR Architectures, the analysis shall include a discussion of the software and hardware alternatives considered for the implementation of the architectures and the set of criteria for choosing among them. (CDRL A004)

3.5 IDS Concept Design. The Contractor shall provide their IDS concept design which includes discussion of asset integration, open architecture and modular concepts, design and construction standards with associated rationale, and use of CANDI. (CDRL A005)

3.5.1 Traceability. The Contractor shall provide traceability to the SPS.

3.6 C4ISR Architecture. The Contractor shall provide a C4ISR architecture for the IDS and for each IDS asset as appropriate. (CDRL A006)

3.6.1 C4ISR Architecture Components. Each C4ISR architecture shall consist of the following components:

3.6.1.1 C4ISR Operational Architecture.

3.6.1.2 C4ISR Systems Architecture.

3.6.1.3 C4ISR Technical Architecture.

3.6.1.4 C4ISR Data Architecture.

3.6.1.5.1 Performance Models. The Contractor shall identify and describe performance models used, including any environmental assumptions (e.g., arrival and distribution of service requests) and assumptions about processing times, that demonstrate that proposed quality of service and deadlines can be met.

3.6.1.6 Security. The Contractor shall provide security specifications for each C4ISR Architecture. They shall identify and describe security models used to arrive at the specifications, including environmental assumptions (e.g., arrival and distribution of intruder attempts, hardware failure rates), the intrusion window, and assumptions about intrusion success probabilities that demonstrate what levels of security can be achieved.

3.6.1.7 Availability. The Contractor shall provide availability specifications for each C4ISR Architecture. They shall identify and describe the availability models used to arrive at the specifications, including environmental assumptions (e.g., hardware and software failure and repair rates), that demonstrate what levels of availability can be achieved.

3.6.1.8 Modifiability. The Contractor shall provide modifiability specifications for each C4ISR Architecture. They shall identify and describe the modifiability models used to arrive at the specifications, including any assumptions of anticipated changes, typically specified as change scenarios, that demonstrate the amount of effort required to implement the specified modifications. Changes to be considered include, but are not limited to, change in existing functionality, incorporation of new CANDI components, and fielding an operational subset of the system.

3.6.1.9 Interoperability. The Contractor shall provide interoperability specifications for each C4ISR Architecture. They shall identify and describe the interoperability models used to arrive at the specifications, including any assumptions of anticipated inter-operation, typically specified as scenarios, that demonstrate the amount of effort required to allow the specified system(s) to interoperate. The specifications shall include a set of applicable systems, such as specific military C4ISR systems, with which the C4ISR Architecture will directly interoperate.

3.6.2 Software Development and Documentation. Each C4ISR architecture shall include a discussion of the proposed software development and documentation processes. This shall include a set of software descriptions, for each software systems proposed, that describes the software components, their connection (data and control) mechanisms, and the properties of these components and connections.

3.6.3 OATP. The C4ISR architectures shall meet the objectives of the OATP, specifically to include the integration of the support programs (i.e., intelligence, logistics, personnel, safety, medical, and hazardous materials).

3.6.4 Coast Guard Data Network. The IDS shall ensure seamless connectivity to the Coast Guard Data Network.

3.6.5 Traceability. The Contractor shall provide traceability to the IDS Concept Design and the SPS.

3.7 Logistics Plan. The Contractor shall provide life-cycle logistics plans for the IDS and for each asset in accordance with the support requirements delineated in the SPS. The logistics plans shall include a discussion of how CANDI will be used in the IDS to control life cycle cost and mitigate risks. (CDRL A007)

3.7.1 Traceability. The Contractor shall provide traceability to each Asset Concept Design, the IDS Concept Design, the C4ISR Architecture, and the SPS.

3.8 Performance Specifications. The Contractor shall provide performance specifications for each asset of the IDS in accordance with MIL-STD-961D and the applicable performance specification templates attached to the CDRL. The specification templates contain design margins and/or standards to be incorporated into the performance specification and concept design. These performance specifications will become part of any resulting design and construction contracts. (CDRL A008)

3.8.1 Traceability. The Contractor shall provide traceability to each Asset Concept Design, the IDS Concept Design, and the SPS.

3.9 Environmental Impact Characteristics. For the purposes of satisfying the requirements of National Environmental Protection Act (NEPA), the Contractor shall provide the range of environmental impact characteristics (i.e., airborne emissions, amount of hazardous material by-products, coatings, waste disposal amounts, excessive electromagnetic emission, etc.) that adversely affect the environment during the life cycle of each asset of their proposed IDS. (CDRL A009)

3.9.1 Traceability. The Contractor shall provide traceability to each Asset Concept Design, the IDS Concept Design, and SPS.

3.10 Asset Concept Design. The Contractor shall provide an asset concept design for each performance specification which includes discussion of IDS and component integration, open

architecture and modular concepts, design and construction standards with associated rationale, and use of CANDI. (CDRL A010)

3.10.1 Standards. Each asset concept design shall include an identification of the applicable design and construction standards, to include software, used in the asset and the rationale for each standard. In those instances where a standard is required by the Government, the rationale will state that requirement.

3.10.2 Traceability. The Contractor shall provide traceability to the IDS Concept Design and the SPS.

3.11 Life Cycle Cost Estimate. In accordance with the guidance provided in the MSMP, the Contractor shall provide a life cycle cost estimate for the proposed IDS and each of the assets for a forty (40) year period commencing in FY 2002. The contractor shall specifically identify any significant life cycle cost reductions (greater than 15% from current asset operating and support baseline costs, which will be provided at contract award in the MSMP). Conceptual costs for any facility impacts shall be included in the life cycle cost estimate. Separate narratives shall be provided for the requirements delineated in paragraphs 3.11.1 through 3.11.3 below. (CDRL A011)

3.11.1 Rationale. The Contractor shall provide the assumptions and rationale used in their life cycle cost estimate.

3.11.2 Maintenance. The Contractor shall propose the process and means for maintaining the life cycle cost information.

3.11.3 Traceability. The Contractor shall provide traceability of life cycle cost allocation to IDS Concept Design, Asset Concept Design, C4ISR Architecture, Implementation Plan and Logistics Plan.

3.12 Implementation Plan. The Contractor shall provide an implementation plan and major milestone schedules for the acquisition and deployment of the proposed IDS, to include a software transition plan, for the IDS and for each asset. The plans and schedules shall assume notional funding of $300M for the first year and out-year funding levels of $500M (1998 dollars). These funding levels, however, are ultimately contingent upon Congressional approval of our budget requests. (CDRL A012)

3.12.1 Acquisition Cost Estimate. The implementation plan shall provide an acquisition cost estimate for the IDS and each asset on a year by year basis.

3.12.2 Risk. The implementation plan shall address cost, schedule and performance risks, with proposed management actions for the IDS as a whole and for each IDS asset.

3.12.3 Simulation-Based Acquisition. The implementation plan shall address how simulation-based acquisition principles will be used to support the development and acquisition of the IDS.

3.12.4 Existing Assets. The implementation plan shall address the continued use, planned upgrade and/or planned phase-out of existing Coast Guard Deepwater assets.

3.12.5 Production Plan. The Contractor shall address the known manufacturing sites and facilities and known service providers for the construction, modification, lease, open-market purchase as appropriate for each IDS asset.

3.12.6 Mission Performance. The implementation plan shall address the actions taken to ensure there will not be any degradation or reduction in the current mission performance during the implementation of the IDS.

3.13 Traceability Matrix. The Contractor shall provide a traceability matrix to and from each requirement listed in Section 3 of the SPS for each of the following: The IDS Concept Design, the C4ISR Architectures, the Logistics Plan, the Performance Specifications, the Environmental Impact Characteristics, and the Asset Concept Design. (CDRL A013)

3.14 Artist Renditions. The Contractor shall provide artist renditions of the proposed IDS and the assets which comprise it. (CDRL A014)

3.15 Reviews. The Contractor shall host, at a minimum, the reviews listed below. These will be working reviews. The Government does not desire the Contractor to prepare elaborate reviews that divert resources away from the IDS effort. The Contractor shall include in their Integrated Master Plan and Integrated Master Schedule reviews for the below areas. If desired, additional reviews may be identified in the Integrated Master Plan and Integrated Master Schedule. Agendas of the proposed reviews as well as minutes of these meetings shall be provided by the Contractor. (CDRL A015)

3.15.1 IDS Drivers and Constraints. This shall include participation at the Deepwater Operations/Logistics Summit on September 22-25, 1998. Costs for five (5) Contractor representatives are included in the fixed price amount of contract line item 0004 as stated in Section B of the contract.

3.15.2 IDS Concept Design.

3.15.3 C4ISR Architecture, Logistics Plan, and Performance Specifications.

3.15.4 Environmental Impact Characteristics, Asset Concept Designs, Life Cycle Cost Estimates, and Implementation Plan.

3.16 Final Study Presentation. At completion of the study, the Contractor shall make an oral presentation with briefing books of the proposed IDS. The presentation shall be at a site agreed upon by the Government and the Contractor after contract award. The format of the presentation and the briefing books to be provided shall be at the Contractor's discretion. The presentation shall not exceed eight (8) hours. (CDRL A016)

3.17 Integrated Product Data Environment (IPDE). The Contractor shall provide and maintain at their facilities an IPDE with controlled access to data via the Internet using a generic off-the-shelf web browser to support the electronic location, access and retrieval of data products for review purposes. The data products requiring view access include all the contract deliverables. Document formats shall be in Microsoft Office 97 compatible applications, compliant with Windows NT 4.0 operating system. Appropriate security measures shall be established between the Contractor and Government after contract award.

3.18 Data Format. The Contractor shall provide data, in the formats defined in the Government provided IDS Modeling and Simulation Master Plan, to support Government assessment of the IDS concepts.

3.19 Functional Design Period Requirements. During the Functional Design period, the Contractor shall satisfy the requirements listed below.

3.19.1 Functional Design Integrated Master Plan (IMP). The Contractor shall submit an IMP that maps their IDS concept against the requirements in this SOW Section 3.19 and explains their approach to accomplish the requirements of this section. The IMP shall include a plan for the development of all required functional design products, including description of task sequencing and the dependencies and interrelationship among tasks and success criteria for task accomplishment; the proposed means for incremental, interim and final presentation and delivery of functional design products in accordance with the CDRL requirements, including proposed documentation format (hard copy, IPDE or other electronic media), utilization of reviews and interactions at the Project Management, SIT, and TAT levels. The IMP, upon government acceptance, will be incorporated into the contract as Attachment 0008. (CDRL A017)

3.19.2 Functional Design Integrated Master Schedule (IMS). The Contractor shall submit an IMS depicting the sequence, timing, and interrelationship of all critical design activities, milestones, reviews, and product deliveries during the functional design period. (CDRL A018)

3.19.3 Configuration Management. The Contractor shall be responsible for establishing and maintaining configuration management of their IDS design during the functional design period, beginning with the establishment of an IDS functional baseline. Configuration management shall be designed for integration over the design, acquisition and sustainment phases of the IDS.

3.19.3.1. Configuration Management Plan (CMP). The Contractor shall submit a CMP describing the procedures to be used to define the IDS configuration baseline, demonstrate traceability of the baseline to SPS requirements, and maintain control of changes to this baseline. The CMP shall identify government and contractor responsibilities in configuration identification, control, audit, and status accounting to establish and maintain the functional, allocated, and product baselines, the transition of configuration management responsibility over the IDS life cycle, and interfaces with legacy configuration management procedures. The CMP shall include the Contractor's Work Breakdown Structure (WBS) and specification tree reflecting their IDS composition and design. The Contractor's WBS shall be mapped to the WBS elements provided in the MSMP. (CDRL A019)

3.19.4 Functional Design Effort. The Contractor shall conduct design and analysis of the IDS, to include updates and revisions to the concept design phase products and other efforts as specified below and in Attachments 1 - 4. The Functional Design product definitions may be tailored to fit the degree of detail of the particular asset design taking into account the timing of its introduction into the system as stipulated by the attachment matrix. The Contractor may provide similar data if the difference between the proposed and similar items is not significant.

3.19.4.1 Concept of Operations (CONOPs) Plan. The Contractor shall develop and maintain a CONOPs Plan that characterizes the IDS system level design and addresses how the IDS will be employed to meet the SPS requirements and respond to the mission demands specified in the MSMP throughout the implementation period. The operational constraints of IDS logistics support and policy (e.g., maintenance and training schedules, personnel considerations) are to be incorporated into CONOPs development and implementation. The CONOPs Plan shall address, at a minimum, asset availability scheduling and the operational logic to utilize the assets including command structure, operational patrol areas, mission prosecution and asset/capability interaction. Further amplification of CONOPs content and format is contained in Appendix D of the MSMP. Selected CONOPs elements as specified in the MSMP (e.g., schedules, OPAREA definitions) are also to be submitted electronically to support operational effectiveness modeling as part of the Electronic Modeling Data Submission (CDRL A031). The CONOPs Plan shall be

maintained throughout the functional design period, and revisions shall be submitted concurrent with operational effectiveness modeling data submissions as defined in SOW Section 3.19.11. (CDRL A020)

3.19.4.2 Air and Surface Asset Designs. The Contractor shall build upon the asset performance specifications (SOW Section 3.8), concept designs (SOW Section 3.10), and other concept design efforts to develop engineering analyses, data, drawings, and other products necessary to document and demonstrate maturation of all IDS Air and Surface asset designs as specified in SOW Attachments 1 and 2. (CDRL A021)

3.19.4.3 C4ISR Architectures. The Contractor shall implement the architecture development process of the C4ISR Architecture Framework V2.0 to complete the C4ISR Architectures. The C4ISR Architectures shall identify C4ISR policies and associated impacts on system, asset and capability operational utilization including CONOPs implications as well as C4ISR interoperability considerations. C4ISR Architecture development shall be demonstrated by the development and submission of the products identified in SOW Attachment 3. (CDRL A022)

3.19.4.4 Logistics Plan. The Contractor shall provide a set of integrated system and asset level logistics support planning documents, as specified in SOW Attachment 4, which together comprise the IDS Logistics Plan and related logistics concept. The Logistics Plan shall build upon the earlier logistics plan (SOW Section 3.7) to reflect the evolution and refinement of the IDS design. The plan level of detail may vary for the IDS and specific assets based upon the proposed implementation timeframe for the introduction of assets and logistics concepts. The Logistics Plan serves as the overall tool for identifying and implementing the overarching logistics concept and support tasks to be accomplished during the design, introduction, service life, and ultimate disposal of the IDS assets. The Logistics Plan shall identify support policies and associated impacts on system, asset, and capability operational utilization including CONOPs implications, scheduling constraints, maintenance cycles and personnel limitations. The Logistics Plan shall summarize how each logistics element is incorporated into system and asset level design. (CDRL A023)

3.19.4.5 Requirements Verification. The Contractor shall update the Requirement Verification Cross-Reference Table of the SPS (SPS Section 4, Table 1) and all derived specifications, identifying the method of verification to be used for each specification requirement. For assets and other IDS components to be procured between years 2002 and 2012 in the Contractor's Implementation Plan, the Contractor shall further describe the proposed verification methods identified in the Verification Cross-Reference Tables to include a description of the specific types, methods and tools of analysis, demonstration, examination, and test to be conducted. For assets and other IDS components to be procured between years 2002 and 2006 in the Contractor's Implementation Plan, the Contractor shall also provide a preliminary schedule of verification events (developmental, production, acceptance and operational). The Contractor shall also present the results of any verification events accomplished during the functional design period of performance. (CDRL A024)

3.19.4.6 Environmental Impact Characteristics. The Contractor shall refine the environmental impact characteristics provided in the IDS Concept Baseline (SOW Section 3.9), to include environmental impacts and characteristics per asset and facility, by NEPA category, including issues, thresholds, and mitigations as required. (CDRL A025)

3.19.5 Total Ownership Cost (TOC). The Contractor shall propose a TOC management methodology for responsible system management throughout the lifecycle of the proposed IDS. The methodology shall provide an overall TOC management philosophy and shall describe roles, processes, types of tools and scope of information (historical, current and projected) required to realize projected TOC. The Contractor shall also identify elements of TOC, as part of the initial mandatory submission, that are beyond the scope of the Contractor proposed LCCE due to lack of sufficient information to develop an appropriate estimate. The Coast Guard will provide estimates for approved elements of TOC. (CDRL A026)

3.19.6 Life Cycle Cost Estimate (LCCE). The Contractor shall refine the LCCE provided in the IDS Concept Baseline (SOW Section 3.11) to reflect the greater detail resulting from the refinement in the C4ISR Architectures, the design of the surface and air assets, the Logistics Plan, and Implementation Plan during the functional design period. Life cycle cost estimates, with supporting assumptions and rationale, shall be provided to the lowest levels for all applicable elements of the WBS provided in the MSMP Appendix D. Data sources shall be provided in presenting the LCCE rationale. (CDRL A027)

3.19.7 Implementation Plan. The Contractor shall refine the implementation plan provided in the concept design phase (SOW Section 3.12) to reflect the greater detail resulting from the refinement in the C4ISR Architectures, design of surface and air assets, and the Logistics Plan, and the resulting IDS operational effectiveness and TOC projections during the functional design period. The requirements of SOW Section 3.12 apply. The Implementation Plan shall present IDS assets and capability implementation on a yearly basis for the life of the IDS. The Contractor shall justify the proposed implementation plan by demonstrating the incremental and accrued performance characteristics and costs over the life of the IDS. (CDRL A028)

3.19.8 Affordability Analysis. The contractor shall conduct sensitivity analyses to explore alternative implementation plans. These analyses shall hold operational expenditure funding targets constant as defined in the MSMP, utilize the assets defined for the baseline implementation plan, hold the end-state IDS constant as defined for the baseline implementation plan, and prohibit any decrease of operational effectiveness. Given these constraints, each analysis shall indicate applicable refinements to the Implementation Plan and identify impacts on system performance and cost. The following analyses shall be conducted: (1) determine the optimal yearly funding stream required to build the IDS that maximizes operational effectiveness over the life of the IDS and minimizes TOC, and (2) determine the minimal funding stream required to build the IDS without violating the minimal effectiveness and cost targets. Affordability life cycle cost estimates and rationale, including the relationship to the baseline LCCE per SOW Sections 3.11 and 3.19.6, shall be provided to the 1st level (e.g., 1.0, 2.0) for all applicable accounting cost categories and elements of the WBS provided in the MSMP Appendix D. The Affordability Analysis is required to support project planning and will not be used for contractor evaluation. The initial submission may utilize the implementation plan delivered during concept design (CDRL A012) as the baseline implementation plan. (CDRL A029)

3.19.9 Reviews. The Contractor shall host the reviews listed below to describe progress made and issues arising during the functional design period. These reviews shall be reflected in the Contractor's revised IMP and IMS. The Contractor shall provide agendas for all reviews and minutes of meetings. (CDRL A030)

3.19.9.1 Functional Design Kickoff & Baseline Review. The Contractor shall conduct a Functional Design Kickoff & Baseline Review meeting to present the Functional Baseline that will be used to proceed into the functional design period of the project. The purpose of this review shall be for the Contractor to (1) present an overview of their configuration management approach; (2) review any proposed changes to the IDS concept design presented at the Concept Design Final Study Presentation; and (3) provide an overview of their approach to the functional design period requirements, critical events and timeline.

3.19.9.2 Technical Reviews. The Contractor shall conduct technical reviews and exchanges at the Project Management, SIT, and TAT levels to demonstrate incremental completion of technical efforts for the IDS, assets and associated components. The Contractor shall propose the subject and timing of reviews.

3.19.9.3 IDS Functional Design Review. The Contractor shall conduct an IDS Functional Design Review to present the results of their functional design period activities. The contractor shall demonstrate completion of all activities specified in SOW Section 3.19 and the SOW Attachments, and the manner and extent to which their IDS design satisfies operational effectiveness and total ownership cost objectives while addressing cost, schedule and performance risks.

3.19.10 Integrated Product Data Environment (IPDE). The Contractor shall continue to maintain an IPDE to communicate work in progress and contract deliverables throughout the functional design period.

3.19.11 Electronic Modeling Data Submission. The Contractor shall provide electronic data as defined in the MSMP to support Government assessment of the Contractor's IDS, including: 1) operational effectiveness modeling data (including CONOPs); 2) cost data; 3) asset/capability validation data; and 4) traceability data. All electronic modeling data shall be delivered in the format specified in the MSMP. For preliminary operational effectiveness modeling data submissions, the Contractor shall submit a single one-year period of data and for a single IDS concept. For the final operational effectiveness modeling data submissions, the Contractor shall submit data for a maximum of the following five one-year periods: 1) Calendar Year (CY) 2004 (Year 3 of the IDS); 2) CY 2007 (Year 6 of the IDS); 3) CY 2011 (Year 10 of the IDS); 4) CY 2016 (Year 15 of the IDS); and 5) the first calendar year that the IDS is fully implemented as indicated in the Implementation Plan. Optional submission opportunities for preliminary data may be provided during the functional design period. Preliminary data submissions will be used to ensure effective data exchange, and the Government will provide feedback on preliminary data submissions. Preliminary data submissions will not be used in the Government's final evaluation. (CDRL A031)

3.20 Cutter Certification Plan (CCP). The Contractor shall conduct a thorough review of the Final Draft of the Cutter Certification Plan. This Plan includes the Implementation Plan and the Generic Certification Matrix. The Implementation Plan is guidance for the development of the cutter specific standards, and the Generic Certification Matrix is an instrument from which the ship specific cutter certification plan will be developed. The intent of this review is to leverage the Contractor's experience with military and commercial surface vessel design, contract management and construction. As such, the Contractor shall complement the generic matrix with applicable equivalent standards for verification on a line item basis. Further, the Contractor shall provide recommended changes to the Implementation Plan and the Generic Certification Matrix with the following considerations:

1. The CCP is an instrument which verifies and ensures the fitness of purpose of the vessel throughout design and construction;

2. Design and construction of a high quality, cost-effective surface asset for a 30-year or more service life should be ensured;

3. Best practices of industry, contractor's designers, and shipyards should be capitalized; and

4. Administrative efficiencies should be achieved.

3.20.1 Cutter Certification Implementation Plan. The Contractor shall provide a modified Implementation Plan with edits and justification for recommended changes. The results of this effort may be applied in part or in whole to the final plan which will be used by all of the Deepwater Project Phase 1 contractors. In addition, the Contractor shall provide an executive summary which describes the approach taken and the resulting outcome of this effort. (A032)

3.20.2 Generic Cutter Certification Matrix of Standards. The Contractor shall edit the Generic Matrix to indicate recommended additions, deletions, and modifications, with a clear rationale for each change. All line items shall be considered. These recommendations may be implemented in part or in whole in the final generic matrix which will be applied by all of the Deepwater Project Phase 1 contractors. (A033)

3.20.3 CCP Working Session. The Contractor shall host a 3-day working session with Government representatives approximately three weeks after the effective date of the contract modification authorizing this effort. The purpose of this session is to review, discuss, and justify the work accomplished. The specific site for this session is at the Contractor's discretion. *The Contractor shall notify the Government of the meeting location no later than 2 weeks in advance of the session*. The Contractor shall provide adequate space and computer resources for this working session for the Contractor's team members and thirteen (13) Government representatives. Further, the Contractor shall be prepared to discuss those standards items of the generic matrix from which the Contractor intends to request deviations. This session is intended to provide a venue for discussion of proprietary issues related to each Contractor's Cutter Specific Certification Matrix. The Government in no way expects this to be a complete list of items with which the Contractor may request deviation, but rather an opportunity to address directly those items which have the most impact on design and construction which have been readily identified as candidates for deviation.

3.21 Functional Design Final Comments Summary. The Contractor shall provide a summary report addressing all comments provided by the Government on the final Functional Design deliverables (CDRLs A019 through A033). Specific substantiating information shall be included for all responses provided in the summary. (A034)

SOW ATTACHMENT 1
AVIATION ASSET
FUNCTIONAL DESIGN PRODUCT DEFINITIONS

DESIGN MATURITY CLASSIFICATION:

NEW – Assets which have not previously been developed, tested, certified, and produced in a substantially similar configuration, and for which IDS Project requirements are the driving factor in establishing primary functional and physical design parameters and verifying their satisfactory achievement.

MOD – Legacy Deepwater Assets which undergo asset or component modification in order to improve service life, performance, supportability, or Total Ownership Cost of the IDS. Design products for modified legacy assets shall address the modified components of the asset, as well as any other components or overall system characteristics that are affected by the modification (including structural, weight & balance, electrical, mechanical, software, etc.). Modification design information requirements also apply to known projected modifications to assets which will initially be introduced into the IDS as New or CANDI assets.

CANDI – Assets which have been developed, tested, certified, and produced in a substantially similar configuration in response to non-USCG government or commercial user needs, with such activities being sponsored and conducted by non-USCG organizations. Although modifications to CANDI assets may be required to produce an IDS variant, such variants will be considered as CANDI so long as fundamental functional and physical design parameters are not significantly affected and only limited redesign and test are required to realize and demonstrate the achievement of performance and safety requirements.

DRAWING CLASSIFICATIONS:

Conceptual Design Drawings – Conceptual Design Drawings shall be prepared as appropriate to define concepts in graphic form, and include appropriate textual information required for analysis and evaluation of those concepts.

Developmental Design Drawings and Associated Lists – Developmental Design Drawings and Associated Lists shall be prepared as appropriate to provide sufficient data to support the analysis of a specific design approach and the fabrication of prototype materiel for test or experimentation (if applicable). Drawings and lists required to present a design approach may vary from simple sketches to complex drawings, or may be a combination of both.

Commercial and Pre-existing Drawings and Associated Lists – Commercial and Pre-existing Drawings and Associated Lists shall be provided as appropriate to provide engineering and technical information in support of end products, or designated portions thereof, which are commercially developed items, commercial off-the-shelf items, or previously developed and documented Government items. These drawings and lists shall be in accordance with the commercial design documentation practices of the contractor or supplier of the item or previously imposed government standards.

FUNCTIONAL DESIGN PRODUCT DESCRIPTIONS:

Asset Performance Specifications – Update of the Asset Performance Specifications delivered in Concept Design to reflect maturation of IDS performance demands on the asset and proposed asset characteristics; allocation of asset-level requirements to its components; and the specification of system and component interfaces.

Revisions to Concept Design – Provide revisions and any increased level of design/analysis of previously delivered concept designs, or, new concept designs as applicable.

Arrangement Drawings – Depiction of the relationship of the major components of the asset using appropriate projections or perspective views to convey a general description of the asset configuration and location of significant items.

Layout Drawings – Pictorial, notational, or dimensional data conveying design solutions used in preparing other engineering drawings. As applicable, Layout Drawings shall be provided to present one or more solutions for meeting basic design parameters as a basis for your evaluation and selection of optimal design approaches; support geometric studies to develop movement of mechanical linkages, clearances, or arrangements; present sufficient details of the design approach for cost estimating and design approval; and depict the final development of the design in sufficient detail to facilitate preparation of detail and assembly drawings.

Modification Drawings – Depiction of changes to an existing asset configuration to enable the addition, removal, or rework of items from the baseline configuration.

Installation Drawings – Depiction of general configuration and complete information necessary to install an item relative to its supporting structure and or to associated items, and in relation to adjacent items. Includes dimensional data, hardware descriptions, and general configuration information for the installation site as applicable.

Electrical/Electronic Diagrams – Depiction, by means of graphical symbols, of the electrical elements, connections and functions of a specific circuit arrangement.

Mechanical Schematics Diagrams – Depiction of mechanical and other functional operation, structural loading, fluid circuitry, or other functions using appropriate symbols and connecting lines. Applicable to hydraulic or pneumatic systems; mechanical systems; rigging; and critical structural items to display loading or lifting data.

Master Equipment List – Identification of major equipment items, which may be separately procured, replaced or supported (e.g. engines, sensors, communications systems, displays, power systems, computer systems, and auxiliary equipment). Level of detail to include specific equipment items used for cost analysis and design development.

Flight Performance Analysis – Analysis of proven and predicted flight characteristics demonstrating that the asset will satisfy IDS requirements reflected in the governing system and asset performance specification in its intended configuration(s) and loads for mission employment in the projected environments.

Airframe Structural Analysis – Analysis of structural loads and airframe response to demonstrate retention of structural integrity, including that of structural components that are modified or affected by other asset or component modifications, in all anticipated configurations, uses and environments.

Asset/Subsystem Analysis – Analysis of the asset and subsytem requirements and resulting functional and physical selection or design characteristics, including interfaces, demonstrating that the selected design will satisfy the specified and allocated performance requirements. Includes analysis of airframe, propulsion, electrical power, applications and system software, communications, navigation, sensors, computers, data displays and controls, flight control, central integrated checkout, and auxiliary equipment.

Aerodynamic Analysis – Analysis of the aerodynamic characteristics and response of the aircraft due to modifications affecting external form or appendages (e.g. probes, antennas, landing gear, etc.)

Availability Analysis – Provide an Availability analysis of the air asset as a component of the Integrated Deepwater System. (Provide reference to Asset Logistics Plan as applicable.)

Safety Analysis – Analysis of critical system safety requirements, design criteria, and design features and characteristics including definition of hazards and failure modes and their probability, severity, consequences, and prevention or mitigation approach. Also provide discussion/analysis of significant issues/evolutions/scenarios that present risks to personal safety and methods employed to mitigate risks. Include emissions/radiation hazards.

Weight & Balance Analysis – Weight statement accounting for structural, component, consumables and payload mass, distribution, and location configuration and limits.

Human Factors Analysis – Analysis of human factors considerations, design guidelines, and design features and characteristics (e.g., physical space limits, arrangements, climatic limits, eye movement, reach, ergonomics, etc.) which affect system and/or asset operation.

Risk Assessment – Identification and analysis of cost, schedule, and performance risk factors associated with recommended design approaches for each proposed asset and asset modification, including the likelihood and consequence of realizing risk concerns, and strategy for management and mitigation of risks. Specifically address those asset elements that impact IDS Operational Effectiveness or Total Ownership Cost.

Technology Assessment – Provide technology forecasts and risks, and rationale for consideration of technologies projected to have potential future applications of benefit to the IDS.

SOW Attachment 1
Air Asset Functional Design Product Requirements

Specifications	Air Asset procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Asset Performance Specfications				**(4)**	**(4)**	**(4)**	**(4)**	**(4)**	**(4)**
Revisions to Concept Design									

Technical Drawings and Information	Air Asset procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Arrangement Drawings	**(2)**		**(3)**	**(1)**		**(3)**	**(1)**		**(3)**
Layout Drawings	**(2)**	**(2)**	**(3)**						
Modification Drawings		**(2)**	**(5)**		**(1)**			**(1)**	
Installation Drawings		**(2)**							
Electrical/Electronic Diagrams	**(2)**	**(2)**	**(3)**	**(1)**	**(1)**	**(3)**			
Mechanical Schematics Diagram	**(2)**	**(2)**	**(3)**	**(1)**	**(1)**	**(3)**			
Master Equipment List	**(2)**	**(2)**	**(3)**	**(1)**	**(1)**	**(3)**			

Analyses	Air Asset procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Flight Performance Analysis				**(4)**	**(4)**	**(4)**			
Airframe Structural Analysis			**(5)**	**(4)**	**(4)**				
Asset/Subsystem Analysis			**(5)**	**(4)**	**(4)**				
Aerodynamic Analysis			**(5)**		**(4)**				
Availability Analysis				**(4)**	**(4)**	**(4)**			
Safety Analysis			**(5)**	**(4)**	**(4)**				
Weight & Balance Analysis				**(4)**	**(4)**	**(4)**			
Human Factors Analysis				**(4)**	**(4)**	**(4)**			
Risk Assessment				**(4)**	**(4)**	**(4)**	**(4)**	**(4)**	**(4)**
Technology Assessment				**(4)**	**(4)**	**(4)**	**(4)**	**(4)**	**(4)**

Note (1) Concept Design Drawing and associated Lists
Note (2) Developmental Design Drawings and associated Lists
Note (3) Commercial and Pre-existing Drawings and associated Lists
Note (4) Level of detail and accuracy for these analyses may be less than that provided for the near term analysis.
Note (5) Required for those modifications to CANDI assets in order to produce an IDS variant.
The Contractor shall perform the tasks indicated by shaded blocks as per the attached product definitions and SOW Section 3.19.4.

SOW ATTACHMENT 2
SURFACE ASSET
FUNCTIONAL DESIGN PRODUCT DEFINITIONS

DESIGN MATURITY CLASSIFICATION:

NEW – Assets which have not previously been developed, tested, certified, and produced in a substantially similar configuration, and for which IDS Project requirements are the driving factor in establishing primary functional and physical design parameters and verifying their satisfactory achievement.

MOD – Legacy Deepwater Assets which undergo asset or component modification in order to improve service life, performance, supportability, or Total Ownership Cost of the IDS. Design products for modified legacy assets shall address the modified components of the asset, as well as any other components or overall system characteristics that are affected by the modification (including structural, weight & balance, electrical, mechanical, software, etc.). Modification design information requirements also apply to known projected modifications to assets which will initially be introduced into the IDS as New or CANDI assets.

CANDI – Assets which have been developed, tested, certified, and produced in a substantially similar configuration in response to non-USCG government or commercial user needs, with such activities being sponsored and conducted by non-USCG organizations. Although modifications to CANDI assets may be required to produce an IDS variant, such variants will be considered as CANDI so long as fundamental functional and physical design parameters are not significantly affected and only limited redesign and test are required to realize and demonstrate the achievement of performance and safety requirements.

DRAWING CLASSIFICATIONS:

Commercial and Pre-existing Drawings and Associated Lists – Commercial and Pre-existing Drawings and Associated Lists shall be provided as appropriate to provide engineering and technical information in support of end products, or designated portions thereof, which are commercially developed items, commercial off-the-shelf items, or previously developed and documented Government items. These drawings and lists shall be in accordance with the commercial design documentation practices of the contractor or supplier of the item or previously imposed government standards.

FUNCTIONAL DESIGN PRODUCT DESCRIPTIONS:

Asset Performance Specifications – Update of the Asset Performance Specifications delivered in Concept Design to reflect maturation of IDS performance demands on the asset and proposed asset characteristics; allocation of asset-level requirements to its components; and the specification of system and component interfaces.

Revisions to Concept Design – Provide revisions and any increased level of design/analysis of previously delivered concept designs, or, new concept designs as applicable.

Ship Principle Characteristics Summary – Used attached template as a minimum of summary data.

Hull Lines Drawing including Appendages – Lines drawings including Body, Plan, Profile views of hull. Drawings of appendages to indicate dimensions and location of interface with hull

Hull Curves of Form Drawing – Curves of Form indicating form coefficients and data as a function of draft or displacement.

Hull Table of Offsets – Hard copy table of offsets of hull and appendages/intersections in sufficient detail to be used to independently replicate hull and appendages. Include electronic copy of information on Microsoft Excel® on 1.44 MB floppy disk.

Deck General Arrangements Drawing – In sufficient detail to show layout of compartments, identification/arrangement of contents in compartment, accesses, and topside equipment.

Inboard/Outboard Profile Drawing – In sufficient detail to show compartments and topside equipment.

Midship Section/Frames & Scantlings Drawing – In sufficient detail to show relative scale, location and to support strength/weight/vibration calculations.

Superstructure & Scantlings Drawing – In sufficient detail to show relative scale, location and to support calculations.

Auxiliary/Distributive Systems Drawing – Include 1-line diagrams including functional components in sufficient detail to support analytical design and analysis for auxiliary and distributive systems.

Machinery Arrangements Drawing – Include arrangements of machinery and auxiliary equipment to show machinery/equipment identification and layout.

Electrical Plant Drawing – Include 1-line diagram from power source/sources (60 hz, 400 hz, other) to load centers/sources. Include power conversion, transfer, distribution and control equipment as applicable. Sufficient detail should be provided to enable assessment of power type/level distribution and control equipment.

Combat System Space Arrangements Drawing – Include drawings of internal/external layout with equipment identification. Provide sufficient detail to discern height, dimensions and clearances of equipment for assessing human factors integration and functionality.

Small Boat Arrangements Drawing – Include drawings which illustrate layout/plans of small boat, equipment used for launch/retrieval and equipment/gear for storage. Nearby interference and clearances surrounding boat shall be illustrated and specified.

Master Equipment List – Identification of major equipment items, which may be separately procured, replaced or supported (e.g. engines, sensors, communications systems, displays, power systems, computer systems, and auxiliary equipment). Level of detail to include specific equipment items used for cost analysis and design development.

Weight and Mass Properties Calculations – Include weight estimation to a minimum of 3-digit (SWBS) level of specificity. Include Longitudinal, Vertical and Athwartship Centers of gravity and KG, LCG, TCG for ship. Include properties for various weight conditions. Provide results

and discuss approach to determining ship mass properties as a rigid body (Mass Data , radii of gyration) used for seakeeping analysis.

Speed/Power Analysis – Provide detailed analysis of ship resistance to include determination of Brake Horsepower required. Include assumptions/margins and reference software/information/technology/models employed. Include analysis of fuel quantity and type requirements for range calculations based on propulsion plant performance.

Propulsion Plant Description/Performance – Provide narrative and performance analysis on propulsion plant. Include functional description and notable aspects of integral/ancillary components from Prime Mover(s) to Propulsor(s) as it applies to the cutter. Include power output at various speeds for comparison to resistance calculations/results. Include designed towing conditions.

Intact and Damage Stability Analysis – Provide these stability analyses and results. Include assumptions/conditions and standards on which each analysis is based and reference software/information/technology employed to conduct each analysis.

Seakeeping Analysis – Provide results of seakeeping analysis and include all assumptions, analytical approaches and data summary on which analysis is based. Reference software/information/technology/models employed.

Area and Volume Report – Include an area/volume report detailing required vs. designed data. Describe the basis from which data was determined. Specify/describe margins employed.

Hull Structure Load and Strength Analysis – Include analysis of determining loads on hull, structural response to loads and description of margins employed

Ship/Shaft Vibration Analysis – Include assumptions and data on which analysis is based, resultant resonant modes/frequencies. Describe methods of analysis and software/information/technology/models employed.

Electrical Load/Power and Machinery Analysis – Include ship's service electrical load analysis for the purpose of determining electrical power required. Discuss conditions under which loads are analyzed and methodology employed for the analysis. Discuss power generation equipment selection and margins employed, as applicable.

Auxiliary/Distributive/Subsystem Design Analysis – Provide analysis of 500 series level systems for assessing sizing and performance.

Combat System Requirements/Analysis – Provide analysis/discussion of combat systems performance. Include demands on ship subsystems, analysis/rationale for placement of components and technical specifications.

Small Boat Performance/Technical Specifications and Analysis – Include analysis of launch and retrieval of small boats and technical feasibility/justification.

Air Asset related Shipboard System Technical Specifications and Analysis – Includes support, traversing, handling equipment as applicable.

Survivability and Damage Control System Analysis – Discuss systems and scenarios considered in the design. Include analysis of performance.

Maneuvering Analysis – Include Tactical/Turning Data, "Zig-Zag Maneuver" (or other directional stability analysis) at various speeds, slow speed control, and crash stop.

Ship Specific Cutter Certification Plan – Provide Ship Specific Cutter Certification Plan. If there are any deviations from the Generic Cutter Certification Matrix, provide a separate listing with analysis/justification to validate deviation. This Ship Specific Cutter Certification Plan is considered "dynamic" and as such is subject to revision beyond its submission as a Functional Design Deliverable to the Government. Provide analysis of how the cutter is to maintain design conditions over the life of the cutter. Provide Design/Construction standard for elements of the design not specifically addressed in the Ship Specific Cutter Certification Plan.

Availability Analysis – Provide an Availability analysis of the surface asset as a component of the Integrated Deepwater System. (Provide reference to Asset Logistics Plan as applicable.)

Safety Analysis – Analysis of critical system safety requirements, design criteria, and design features and characteristics including definition of hazards and failure modes and their probability, severity, consequences, and prevention or mitigation approach. Also provide discussion/analysis of significant issues/evolutions/scenarios that present risks to personal safety and methods employed to mitigate risks. Include emissions/radiation hazards.

Risk Assessment – Identification and analysis of cost, schedule, and performance risk factors associated with recommended design approaches for each proposed asset and asset modification, including the likelihood and consequence of realizing risk concerns, and strategy for management and mitigation of risks. Specifically address those asset elements that impact IDS Operational Effectiveness or Total Ownership Cost. (e.g. Power plant performance, Small boat launch/retrieval performance, sensor performance). Indicate measures taken to mitigate risk.

Human Factors Analysis – Analysis of human factors considerations, design guidelines, and design features and characteristics (e.g., physical space limits, arrangements, climatic limits, eye movement, reach, ergonomics, etc.) which affect system and/or asset operation.

Replenishment at Sea Analysis – The contractor shall provide discussion and analysis of equipment and methods employed to conduct Continuous Alongside Underway Replenishment and Vertical Replenishment as it applies to the cutter. Personnel, space, and equipment requirements shall be stipulated as well as analysis of performance of equipment.

Vulnerability to Magnetic Mines Analysis – Provide discussion and analysis of equipment/methodologies employed for reducing the vulnerability to magnetic mines.

Implementation of specific Asset C4ISR Architectures – Provide discussion including considerations and strategy for shipboard C4ISR architecture which includes communications systems, information processing, sensors. Include analysis/discussion of interfaces and ship design impact of installed systems. Include analysis of sensor placement for optimal performance.

SOW Attachment 2
Surface Asset Functional Design Product Requirements

Specifications	Surface Asset Procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Asset Performance Specfications				**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**
Revisions to Concept Design									
Ship Principal Characteristics Summary							**(1)**		

Technical Drawings and Information	Surface Asset Procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Hull Lines Drawing including Apendages									
Hull Curves of Form Drawing									
Hull Table of Offsets									
Deck General Arrangements Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Inboard/Outboard Profile Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Midship Section/Frames & Scantlings Drawing			**(2)**			**(2)**			
Superstructure & Scantlings Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Auxiliary/Distributive Systems Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Machinery Arrangements Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Electrical Plant Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Combat System Space Arrangements Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Small Boat Arrangments Drawing			**(2)**	**(1)**	**(1)**	**(2)**			
Master Equipment List			**(2)**			**(2)**			

Analyses	Surface Asset Procurement or modifications scheduled in years								
	2002-2006			**2007-2011**			**2012-2042**		
	New	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*	*New*	*Mod*	*CANDI*
Weight and Mass Properties Calculations				**(1)**	**(1)**				
Speed/Power Analysis				**(1)**	**(1)**	**(1)**			
Propulsion Plant Description/Performance				**(1)**	**(1)**	**(1)**			
Intact and Damage Stability Analysis				**(1)**	**(1)**	**(1)**			
Seakeeping Analysis				**(1)**	**(1)**	**(1)**			
Area and Volume Report				**(1)**	**(1)**				
Hull Structure Load and Strength Analysis				**(1)**	**(1)**	**(1)**			
Ship/Shaft Vibration Analysis				**(1)**	**(1)**	**(1)**			
Electrical: Load/Power and Machinery Analysis				**(1)**	**(1)**	**(1)**			
Auxiliary/Distributive/Subsystem design Analysis				**(1)**	**(1)**	**(1)**			
Combat System Requirements/Analysis				**(1)**	**(1)**	**(1)**			
Small Boat Performance/Tech Specs & launch/retrieval Analysis				**(1)**	**(1)**	**(1)**			
Air Asset related Shipboard Systems Tech Specs & Analysis				**(1)**	**(1)**	**(1)**			
Survivability and Damage Control System Analysis				**(1)**	**(1)**	**(1)**			
Maneuvering Analysis				**(1)**	**(1)**	**(1)**			
Cutter Specific Certification Matrix				**(1)**	**(1)**	**(1)**			
Availability Analysis				**(1)**	**(1)**	**(1)**			
Safety Analysis				**(1)**	**(1)**	**(1)**			
Risk Assessment				**(1)**	**(1)**	**(1)**			
Human Factors Analysis				**(1)**	**(1)**	**(1)**			
Replenishment at Sea Analysis				**(1)**	**(1)**	**(1)**			
Vulnerability to Magnetic Mines Analysis				**(1)**	**(1)**	**(1)**			
Implementation of specific asset C4ISR Architectures				**(1)**	**(1)**	**(1)**			

Note (1) Level of detail and accuracy for these products may be less than that provided for the near term analysis.
Note (2) Commercial and Pre-existing Drawings and associated Lists
The Contractor shall perform the tasks indicated by shaded blocks as per the attached product definitions and SOW 3.19.4.

SOW Attachment
Ship Principal Characteristics

Surface Asset Name

General	Value/Info	Units
Year 1st Ship implemented		n/a
Number of ships in Class		n/a

Geometry	Value/Info	Units
Hull Type		n/a
LOA		
LWL		
Draft (Full Load)		
Prop Extend Below Keel		
Displ. (LS)		
Displ. (FL)		
Beam (WL)		
Beam Max		
C_B at full load		n/a
C_P at full load		n/a
C_M at full load		n/a
C_{WP} at full load		n/a

Speed	Value/Info	Units
Max Continuous		Knots
"Endurance"		Knots
Max Speed/Length Ratio		Knots/root(LWL(ft))

Propulsion	Value/Info	Units
Prime Mover Config/type		n/a
Engines		n/a
HP (100% MCR)		
Prop Type		n/a
Max Prop RPM		
Prop Diameter		

Electric Plant	Value/Info	Units
Configuration		n/a
Powered by…		n/a
Rating		

Margins/Service Life/Design (by system)	Value/Info	Units
Displacement		
KG		
Electrical		
Propulsion		
Volume		
Area		

Surface Asset Name

Small Boats (for each type)	Value/Info	Units
# Boats		n/a
Range		NM
Endurance		Hours
Max Speed		Knots
Pers Capacity		
Propulsion System		
Propulsor Type		
Launch/Retrieve Location		
Launch/Retrieve Equip		

SOW ATTACHMENT 3
C4ISR ARCHITECTURE
FUNCTIONAL DESIGN PRODUCT DEFINITIONS

AV-1 Overview and Summary Information shall contain the following:

- Identification – A descriptive architecture name & the date developed.
- Purpose – An explanation of why the architecture is needed, what is being demonstrated, which analyses and decisions it will support, and a listing of required capabilities deriving from a variety of sources (e.g. SPS, USCG C4I Objective Architecture & Transition Plan (OATP), USCG C4I Baseline Architecture, vision statements, known operational and engineering issues, etc.)
- Scope - The time frame covered by the Architecture (as-is, transitional, or to-be) and the identification of views and the list of products contained in the Architecture.
- Context - Discuss interrelated conditions, identify all assumptions and constraints as well as all sources for rules, criteria and conventions.
- Findings - Identify shortfalls, recommended systems implementations and opportunities for technology insertion.
- Tools & File formats - Describe the software tools and databases used in developing the architecture and provide reference locations in the deliverable to assist the Government analyze the schema, structure, and data formats to enable architecture analysis.

AV-2 Integrated Dictionary - The initial Integrated Dictionary consists of elements from the Core Architectural Data Model (CADM), the Hierarchical Data Dictionary (HDD), the Defense Data Dictionary System (DDDS), the Coast Guard Data Dictionary and the Joint Information Exchange Requirement Analysis Database (JIERAD). The Contractor shall create an IDS Integrated Dictionary based on the above documents, extended with USCG elements not contained in the above documents. In addition, the Contractor shall include the following types of entries in their AV-2:

- Lists and definitions of the items, entities, and terms used and/or presented in the architecture and products based on the three dictionaries cited above. This includes entries in tables, graphics (e.g., boxes, ovals, icons, lines, notes, etc. The format for each graphical item is prescribed in the C4ISR Architecture Framework V2.0 Appendix A.) and annotations.
- Attributes of the items.
- If a pick list is used, list possible entries for items and the relationship of each item to other items in the dictionary.

OV-1 High Level Operational Concept Graphic shall contain the following:

- Major nodes in an *overarching* setting. As the IDS is a *fully integrated* system, the nodes shall include support nodes as well as operational nodes and other USCG organizational activities, i.e., nodes and connectivity derived from the activities resulting from SPS paragraph 3.10 and subparagraphs.
- A textual description of the key capabilities of the overall IDS concept of operations.

- Connectivity among physical nodes
- OV-1 shall depict all SPS missions, high-level operations, organizations & the geographic distribution of physical assets.

OV-2 Operational Node Connectivity Description shall contain the following:

- Operational and support nodes, the SPS-derived activities (from OV-5) performed at each node and the connectivity and information flows (hereafter called need lines) between nodes
- Annotations, either on the needlines or in accompanying text, describing the general characteristics of data and correlated to OV-3.
- A node list containing the following:
- Title (or common name spelled out and abbreviated)
- Description (what the node does, its functional responsibility, etc.)
- Possible locations where logical nodes, if appropriate, could be located (usually one of the physical nodes). As an example, a SAR On-Scene Commander (OSC) could reside on an Long Range Surveillance (LRS) aircraft or a High Endurance Cutter (HEC). This is not a list of specific geographic locations.
- A listing of what other classes of nodes could serve as the node under consideration. As an example, a HEC Commanding Officer could also be a Commander, Task Unit (CTU).

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OV-3 Operational Information Exchange Matrix shall contain the following:

- Descriptions of the activity-based information exchange requirements between nodes. The descriptions shall:
  - Correlate to the Integrated Dictionary (AV-2).
  - Use data groupings to annotate need lines at a level commensurate with the level of the entities exchanging the information
  - Decompose such that the lowest level yields to mapping to fields in Physical Data Model (SV-11)
- Correlate to the Interoperability Specification via the Levels of Systems Interoperability (LISI) Reference Model
- Correlate to the need lines on OV-2

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OV-4 Command Relationships Chart shall contain the following:

- Operational and administrative command organization including the chain of command associated with the nodes performing the mission
- Annotations, either on the chart or in accompanying text, of relationships between nodes to provide clarity.

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OV-5 Activity Model shall contain the following:

- Decompose SPS-based activities, the relationships between the activities (including activities outside the architecture), I/Os, constraints and the mechanisms that perform those activities.
- Level of detail for the decomposed activities corresponds to the level of the information exchanges in OV-3.
- Information flows and activity relationships should be defined and captured in Data Dictionary as a Pick List.

SV-1 System Interface Description A system interface is a simplified or generalized representation of an interconnection, communications pathway or network, usually depicted graphically as a line with amplifying information either on the diagram or in accompanying text. For SV-1, the Contractor shall:

- Assign systems and their interfaces to the nodes and need lines described in OV-2
- Identify interfaces as either internal to the IDS or external to the IDS.
- Distinguish between legacy system and assets and those that need to be acquired or provided.

SV-2 Systems Communications Description shall contain the following:

- Depiction of the systems-level or physical aspects (i.e., communications medium or circuits) of the information need-lines represented in the System Interface Description (SV-1).
- For each intranodal SV-2 (Asset C4ISR Architecture) there shall be a depiction of the interface between existing systems allocated to the nodes.

SV-3 Systems^2 Matrix shall contain system to system relationships, coordinated with SV-8 to show system evolution (near-term, mid-term and far-term).

SV-4 Systems Functionality Description shall contain the following:

- Functions performed by systems.
- Information flow among system functions.
- A function list, which shall include:
- The name of the function.
- A description of the function (what it accomplishes in the system).
- The function's inputs and outputs.

SV-6 System Information Exchange Matrix shall contain the following:

- Description of information exchanges among the system elements. For example, the position, velocity and accuracy information that is passed from an asset's navigation system to a sensor.

- System-specific details of protocols, data formats and media formats, all correlated to the Data Architecture.
- LISI Reference Model prescribed enabling capabilities (e.g., “Interconnection Requirements Matrix”).

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SV-8 System Evolution Description shall contain the following:

- A description of the process that will be used to manage the evolution of the C4ISR Architectures and the Data Architecture over the life of the IDS, including the incremental steps to evolve the legacy C4ISR Architectures into your IDS C4ISR Architectures.
- A description of the system engineering process that will be used to take the higher-level C4ISR Architecture requirements down to the lower-level selection of asset-specific pieces of hardware and software.
- A description of the linkage mechanism between the Asset C4ISR Architectures and the appropriate sections of the asset performance specifications and work breakdown structure (WBS).

SV-9 System Technology Forecast shall contain the following:

- Emerging technologies that, in the opinion of the Contractor, have possible applications in the IDS or will possibly affect future development of the architectures.
- A technology transition plan linking new and emerging technology to C4ISR systems.
- Domains include information collection and recording, information exchange, information support, and decision support.

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TV-1 Technical Architecture Profile shall contain the following:

- Extraction of standards that the Contractor used in the development of their IDS C4ISR Architecture
- At the internodal level (IDS C4ISR Architecture), overarching descriptions of the Security, Availability, Modifiability, Interoperability Specifications as per SOW Section 3.6.1.6 – 3.6.1.9; and Performance Specification as per the following: Provide performance specifications for each C4ISR Architecture. Identify and describe performance models used to arrive at the specifications, including any environmental assumptions (e.g. arrival and distribution of service requests) and assumptions about processing times that demonstrate what levels of performance can be achieved.
- At the intranodal level (Asset C4ISR Architectures), details of how the Security, Availability, Modifiability, Interoperability Specifications as per SOW Section 3.6.1.6 – 3.6.1.9; and Performance Specification as per the following: Provide performance specifications for each C4ISR Architecture. Identify and describe performance models used to arrive at the specifications, including any environmental assumptions (e.g. arrival and distribution of service requests) and assumptions about processing times that demonstrate what levels of performance can be achieved, were implemented.

TV-2 Standards Technology forecast shall contain the following:

- Emerging standards that, in the opinion of the Contractor, have possible applications in the IDS or will possibly affect future development of the architectures.
- Domains include information collection and recording, information exchange, information support, and decision support.

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SV-11 Physical Data Model (PDM) The Contractor shall:

- Create a PDM consisting of message formats and file structures from Coast Guard legacy systems expected to be in use in 2002 to 2006 and from systems required for frigate-like IT-21 compliance and describe the schema, format and structure of the PDM.
- Update the PDM's populated data base as needed during Functional Design.

Data Schema shall contain a description of how categories, data elements and value types are organized.

Data Architectures The Data Architecture consists of the Integrated Dictionary (AV-2), a Logical Data Model (LDM), a Physical Data Model (SV-11), and a database. The CADM suffices for the LDM, and both AV-2 and SV-11 are already provided, the contractor shall provide:

- Any USCG extensions for the CADM (if needed, in a CADM-compliant format).
- A database supporting all C4ISR Architecture Framework products required by this SOW.
- The assumptions for the Data Architecture (for example: Information management assumptions such as the creation of a central Coast Guard data repository or dependencies on entities outside the IDS. Protocols and standards for elements such as information synthethis, data fill, update and retrieval or reporting and manipulation. Data sources.).

Software Development and Documentation shall include a discussion of the proposed software development and documentation processes. This shall include a set of software descriptions, for each software system proposed, that describes the software components, their connection (data and control) mechanisms, and the properties of these components and connections.

SOW Attachment 3

C4ISR Architecture Framework Functional Design Product Requirements

IDS C4ISR Architecture	
AV-1 Overview and Summary Information	
AV-2 Integrated Dictionary	
OV-1 High Level Operational Concept Graphic *	
OV-2 Operational Node Connectivity Description (Internodal) *	
OV-3 Operational Information Exchange Matrix (Internodal) *	
OV-4 Command Relationships Chart *	
OV-5 Activity Model *	
SV-1 System Interface Description (Internodal) *	
SV-2 Systems Communications Description (Internodal) *	
SV-3 Systems2 Matrix (Internodal) *	
SV-4 Systems Functionality Description (Internodal)	
SV-6 System Information Exchange Matrix (Internodal) *	
SV-8 System Evolution Description	**(1)**
SV-9 System Technology Forecast	**(2)**
TV-1 Technical Architecture Profile (Internodal)	
TV-2 Standards Technology Forecast	

Asset C4ISR Architecture	
OV-2 Operational Node Connectivity Description (Intranodal) *	**(3)**
OV-3 Operational Information Exchange Matrix (Intranodal) *	**(3)**
SV-1 System Interface Description (Intranodal) *	**(3)**
SV-2 Systems Communications Description (Intranodal) *	**(3)**
SV-3 Systems2 Matrix (Intranodal) *	**(3)**
SV-4 Systems Functionality Description (Intranodal)	**(3)**
SV-6 System Information Exchange Matrix (Intranodal) *	**(3)**
TV-1 Technical Architecture Profile (Intranodal)	**(3)**

IDS C4ISR Data Architecture	
SV-11 Physical Data Model	
Data Schema	
Data Architecture	
Software Development and Documentation	**(1)**

* Joint C4ISR Analysis/Planning System (JCAPS) Supported Product

Note (1) This task applies to the fully implemented IDS. The level of detail and accuracy for tasks beyond 2006 may be less than that provided for the near term analysis.

Note (2) This task applies to the IDS as implemented through 2042. The level of detail and accuracy for tasks beyond 2006 may be less than that provided for the near term analysis.

Note (3) This task applies to the Assets procured or modified through 2006.

The Contractor shall perform the tasks indicated by shaded blocks as per the attached product definitions and SOW 3.19.4.